and greater prominence given to habits. So far, however, as we can see, the author appears to have recorded little or nothing new in regard to the latter, and we venture to think that he has missed an opportunity of giving fuller detail as to adaptation to environment, especially as regards coloration. Neither is he to be congratulated as regards his style in many parts of the work, as witness the following sentences in the description of the bearded tit (p. 184):—"The family characters are the same as the generic ones. It is found in various parts of Europe and Asia." It may be also pointed out that "Obb" (p. 261) is not the name of a well-known Siberian river. Again, the introduction of the word "Raptores" in connection with a cut on p. 84 is unnecessary and puzzling, when it is not, so far as we can see, used in the text. And this reminds us that a glossary of *eight* items seems strangely inadequate in a work where a considerable number of technical terms are necessarily employed, for we quite fail to see why it is necessary to explain the meaning of "aftershaft" and leave the reader to find out the signification of "primary."

As regards the illustrations, we have nothing but commendation to bestow, the full-page plates by Mr. Whymper—and especially the one of kingfishers—being exquisite delineations of bird-life. We notice, however, that the small text-figures of birds' heads are for the most part the well-known cuts of Swainson, which were used *with full acknowledgment* by Prof. Newton in his "Dictionary of Birds." Why, we may ask, has the author thought fit to depart from this excellent practice, and to publish the cuts in question as though they were original? R. L.

The Bermuda Islands. By A. E. Verrill, Yale University. (Published by the Author, New Haven, Conn., U.S.A., 1902.)

IN this book, reprinted from the *Transactions* of the Connecticut Academy of Sciences, Prof. Verrill gives an account of the Bermuda group which is intended to subserve four distinct purposes; first, that of a general guide-book on the history, structure, and productions of the islands, for the use of visitors; second, of an introductory text-book to the study of the natural history of the archipelago; third, of a record of the more important changes in the flora and fauna already caused by man; and, lastly, that of a general introduction to a series of more technical memoirs, by the author and other naturalists, on the natural history and geology of the islands, now in course of publication. The present volume includes a general description of the islands, an account of their physical geography and meteorology, a sketch of their discovery and early history, and an account of the animals and plants introduced or exterminated since their discovery by the Spaniards about 1510. The last part of Prof. Verrill's work is of special value, for, so far as appears, no human being had set foot on the islands before that date. Accounts of the geology and marine zoology of the group are promised in a later volume. The book is illustrated by thirty-eight excellent plates, and a large number of cuts, and a valuable bibliography is appended.

La Pratique des Fermentations industrielles. By E. Ozard. Pp. 168. (Paris: Gauthier-Villars, n.d.) Price 2.50 francs.

THIS book is intended specially for the use of brewing chemists. The author gives the essential principles underlying the various fermentation processes, which allow of the transition of sugars and starches into alcoholic products, and also broadly indicates how those processes are carried out in practice.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Psychophysical Interaction.

A BRIEF note to remove a possible misunderstanding suggested by Prof. Minchin. He seems to think, or to imagine that others will think, that when speaking of the action of mind on matter I conceive of mind as a thing that can sustain a "reaction"; so that a stress might exist with matter at one end and mind at the other. Such an absurdity would indeed play havoc with the laws of mechanics; at any rate, I never entertained such a notion for a moment, whether for a guiding or for any other kind of force. If I lift a table it is quite certain that the weight of the table, *plus* its mass-acceleration, is transmitted through my boots to the floor: so far mechanics is supreme. But not even Prof. Minchin could calculate whether I shall lift the table or not, nor what I shall do with it when I have lifted it. I should obey every law of mechanics if I cast it on a bonfire; but I should have interfered with the course of nature, regarded as a mechanically determinate problem, even by only lifting it.

I want to understand the nature of this interference better; I have no other "anxiety" on the subject.

Incidentally I should like to transfer to your pages a most interesting and clearly-worded claim made by Sir W. T. Thiselton-Dyer in to-day's *Times*:—

"Directive power . . . wipes out [meaning would wipe out if it were established] . . . the whole position won for us by Darwin. It is no use mincing matters. Students of the Darwinian theory must be permitted to know the strength and weakness of their dialectic position. What that theory did was to complete a mechanical theory of the Universe by including in it the organic world." It is the last sentence to which I would direct attention.

Athenæum Club, May 15. OLIVER LODGE.

I AM not clear that it is wise to endeavour to aid Sir Oliver Lodge out of the pit he has, it seems to me, quite unnecessarily fallen into. But I will put a rope down to him, as it must be very uncomfortable down at the bottom.

Almost every mechanical problem leads by the application of ultimate mechanical principles to a differential equation. The solution of this equation involves a certain number of constants which may be infinitely many, but which we always find to be absolutely determined by the initial conditions. At first sight it seems difficult, without tacitly dropping a fundamental mechanical principle—such as that of momentum—to allow for "guidance" and "freewill" therein. But differential equations occasionally admit of *singular solutions*. We may follow up a particular solution, absolutely defined by the initial conditions, until we run onto the singular solution. After this we can stick to the singular solution or leave it again at any other contact with a particular solution, which will still satisfy the fundamental differential equation. Can "guidance" and freewill correspond to a shunt of this kind?

I am quite unaware of any differential equation in mechanics providing a good illustration of this suggestion. Still, we must get Sir Oliver up to the surface again, and this is the only rope by which I can conceive him ascending. κ.λ.π.ν.

"Red Rain" and the Dust Storm of February 22.

THE Marquess Camden recently sent me a sample of fine sand or dust collected from the roof of Bayham Abbey, Lamberhurst, shortly after the great dust storm of February 22, which I have caused to be examined. As the results appear to be of interest, especially in reference to Mr. Clayton's contribution to the *Proceedings* of the Chemical

Society, I should be glad if you could find space in NATURE for an account of them.

The dust consisted essentially of ferruginous sand, chalk, and silicates of alumina, alkalis, lime and magnesia, mixed with a certain quantity of organic matter and with an appreciable proportion of lead.

The last-named substance is probably due to the sample having been collected from a leaded roof. It may either have been scraped off during the taking of the sample, or, possibly, cut from the leads by the impact of sand particles driven against the roof by a high wind. Traces of tin and arsenic were also present in the sample; these were probably contained as impurities in the lead.

The detailed results of the analysis are as follows:—

(Substance dried at 100° C. before analysis.)

	Per cent.
Loss on heating to redness	11·28
Lead, calculated as oxide	3·31
Arsenic	0·01
Tin	Traces

After deducting the lead, tin and arsenic as being probably adventitious, the remainder of the sample is made up of the following constituents:—

	Per cent.
Silica	45·94
Alumina	18·35
Iron oxide	6·57
Lime	8·64
Magnesia	1·86
Alkalis { Sodium oxide	1·16
Alkalis { Potassium oxide	2·30
Carbonic acid	6·10
Water and organic matter	9·08
	100·00

The organic matter contained 2·19 per cent. of carbon and 0·16 per cent. of nitrogen, the two representing, probably, between 3 and 4 per cent. of organic constituents.

After being heated to redness, 33·30 per cent. of the sample was found to be soluble in hydrochloric acid, the dissolved portion including practically the whole of the lead, with the traces of tin and arsenic. Again deducting those elements, the dissolved constituents were as follows:—

	Per cent.
Silica	0·64
Alumina	11·20
Iron oxide	5·43
Lime	8·19
Magnesia	1·13
Alkalis	1·46
Carbonic acid	3·48
	31·53

Thus about one-third of the sample is dissolved by hydrochloric acid, including the greater part of the alumina, iron, lime and magnesia, but only a small fraction of the silica.

Dilute acetic acid readily dissolved out the greater part of the lime, with liberation of carbonic acid gas. Water alone dissolved practically nothing from the sample except minute traces of lime. These results show that most of the lime is present in the sample in the form of chalk.

One or two particles of metallic lead were detected in the sample, together with others partly oxidised and carbonated.

It has been surmised by Dr. Mill and others that the sand which accompanied the storm of February 22, and was observed to fall in a great number of places in this country as well as on the Continent, was originally derived from the African deserts.

It would be interesting in this connection to compare its characters with that of the dust, also presumably of African origin, which was observed to fall in the neighbourhood of Taormina, by Sir Arthur Rücker, and was made the subject of an interesting communication to NATURE by Prof. Judd about a year ago.

T. E. THORPE.

Government Laboratories, London, W.C.

The Undistorted Cylindrical Wave.

THE receipt of a paper by Prof. H. Lamb, "On Wave Propagation in Two Dimensions" (*Proc.* Lond. Math. Soc., vol. xxxv. p. 141), stimulates me to publish now a condensation of a portion of a work which will not be further alluded to. I once believed that there could not be an undistorted cylindrical wave from a straight axis as source. But some years ago the late Prof. FitzGerald and I were discussing in what way a plane electromagnetic wave running along the upper side of a plane conducting plate, and coming to a straight edge, managed to turn round to the other side. Taking the wave as a very thin plane slab, one part of the theory is elementary. The slab wave itself goes right on unchanged. Now Prof. FitzGerald speculatively joined it on to the lower side of the plate by means of a semi-cylindrical slab wave. I maintained that this could not possibly work, because the cylindrical wave generated at the edge was a complete one, causing backward waves on both sides of the plate. Moreover, it was not a simple wave, for the disturbance filled the whole cylindrical space, instead of being condensed in a slab. It was in the course of examining this question that I arrived at something else, which I thought was quite a curiosity, namely, the undistorted cylindrical wave.

Maxwell's plane electromagnetic wave consists of perpendicularly crossed straight electric and magnetic forces, in the ratio given by $E=\mu v H$. Thinking of a thin slab only, it travels through the ether perpendicularly to itself at speed v, without any change in transit. I have shown that this may be generalised thus. Put any distribution of electrification in the slab, and arrange the displacement $\mathbf{D}$ in the proper two-dimensional way, as if the medium were non-permittive outside the slab. Then put in $\mathbf{H}$ orthogonally, according to the above mentioned rule, and the result is the generalised plane wave, provided the electrification moves with the wave. Otherwise, it will break up. Another way is to have the electrification upon fixed perfectly conducting cylinders arranged with their axes parallel to the direction of propagation.

Now the first kind of plane wave has no spherical analogue, obviously. But I have shown that the other kinds may be generalised spherically. Put equal amounts of positive and negative electrifications on a spherical surface arranged anyhow. Distribute the displacement in the proper way for a spherical sheet, as if constrained not to leave it. Then put in $\mathbf{H}$ orthogonally as above. The result constitutes an undistorted spherical electromagnetic wave, provided the electrification moves radially with the wave, and attenuates in density as its distance from the centre increases, in the proper way to suit $\mathbf{E}$ and $\mathbf{H}$. This attenuation does not count as distortion. Similarly, the other sort of generalised plane wave may be imitated spherically by having conical boundaries.

But when we examine the cylinder, there is apparently no possibility of having undistorted waves. For with a simple axial source it is known that if it be impulsive, the result is not a cylindrical impulse, but that the whole space up to the wave front is filled with the disturbance. It is easy to see the reason, for any point within the wave front is receiving at any moment disturbances from two points of the source on the axis, and there is no cancellation. And if the source be on a cylindrical surface itself, producing an inward and an outward wave, the whole space between the two wave fronts is filled with the disturbance.

How, then, is it possible to have an undistorted wave from a straight line source? By not arguing about it, but by showing that it can be done. The reason will then come out by itself. As the solution can be easily tested, it is only necessary to give the results here. Take plane coordinates r and θ. Let the magnetic force be perpendicular to the plane, of intensity H. Let Z be its time-integral, then

$$Z=\frac{\cos\frac{1}{2}\theta}{vr^{\frac{1}{2}}}f(vt-r), \qquad H=\frac{\cos\frac{1}{2}\theta}{r^{\frac{1}{2}}}f'(vt-r), \qquad (1)$$

expresses the magnetic field, f being an arbitrary function. Now the displacement $\mathbf{D}$ is the curl of $\mathbf{Z}$. So if E_1 is the radial component of $\mathbf{E}$, and E_2 the tangential component, in the direction of increasing θ, we have the electric field given by

$$E_1=\frac{-\mu v\sin\frac{1}{2}\theta}{2r^{\frac{1}{2}}}f, \qquad E_2=\frac{\mu v\cos\frac{1}{2}\theta}{r^{\frac{1}{2}}}f'+\frac{\mu v\cos\frac{1}{2}\theta}{2r^{\frac{1}{2}}}f. \qquad (2)$$